

McCULLOUGH RESEARCH

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PRINCIPAL

Date: January 2, 2014
To: McCullough Research Clients
From: Robert McCullough
Subject: Review of the November 2013 Energy Northwest Study

On December 13, 2013, Energy Northwest released a study entitled “Columbia Generating Station: Economic assessment.”^{1,2} This study was largely a reissue of an earlier and somewhat more accurate study released in May.³

Replacing the arbitrary (and erroneous) assumptions with actual data from Energy Northwest filings and IHS CERA forecasts, changes the results dramatically -- \$5.76 billion for Columbia Generating Station (CGS) versus \$2.91 billion for natural gas units using data from the Kalama Energy Center.

The structure of their study is very simple. It compares CGS with an assumed natural gas unit built in 2020. The natural gas unit’s cost is reported to be 6.8 cents per kilowatt-hour (kWh) – roughly twice the cost of Energy Northwest’s own Kalama Energy Center (KEC) as presented to the Energy Northwest board on numerous occasions.⁴ The Kalama data used here is taken from Energy Northwest regulatory filings. The Kalama unit was cancelled in 2013 due to market conditions.

So how do Energy Northwest’s detailed studies on the Kalama project compare to the massively more expensive alternative project in the November study? And why did the costs of a proposed combined cycle gas turbine (CCGT) project double in the recent study?

¹ CERA. *Columbia Generating Station: Economic assessment*. 6 Nov. 2013.

² Although dated November 2013, the study had clearly been prepared before the FY 2014 budget data was published, since it depends on CGS data from mid-2011 and mid-2012. It also, missed the significant court decision on November 19, 2013 that significantly reduced nuclear fuel costs.

³ Energy Northwest. *Columbia Generating Station Value Study Draft a/o May 4, 2013*. 4 May 2013.

⁴ For example:

Energy Northwest. *Minutes of Energy Northwest Regular Executive Board Meeting*. 25 June 2009. Page 11.

The answer to the first question is that the actual studies for the proposed Kalama Energy Center indicated that it was cheaper, more efficient, and less polluting than the assumed project in the November report. The second answer is that the massive cost increase is a combination of arithmetic errors, incorrect or dated assumptions, and resource planning errors.

Erroneous Assumptions

The question asked in both Energy Northwest studies is whether the Columbia Generating Station should be replaced by a natural gas combined cycle unit. In both studies a variety of questionable assumptions make the results doubtful. For example, the most recent study simply assumes that natural gas prices in the future will be the same as those experienced over the last twelve years. This assumption is wildly inconsistent with respected industry forecasts and actual forward prices.⁵

Two primary sources were not consulted in the most recent study. These are the proposed costs for the Kalama Energy Project – an actual combined cycle unit proposed by Energy Northwest – and the 2014 10 Year Strategic Plan for the Columbia Generating Station. Values from these sources are significantly inconsistent with the new study.

On May 16, 2013, Energy Northwest issued their most recent CGS Long Range Plan.⁶ This is the official forecast for operating and capital expenses for the next decade. For reasons that are not made clear, Energy Northwest's November report appears not to have used these values in their analysis. Instead, they used considerably lower values than the official forecast for incremental capital expenses and operations and maintenance (O&M).

For the past four years Energy Northwest has attempted to build a major new natural gas unit at Kalama, Washington. The project had few similarities to the proposed replacement project in the November report. For example, it was significantly less expensive, located at load center, used market priced natural gas, and had lower operating costs. It was also designed to operate as an easily displaced unit for integration with wind generation.

⁵ See, for example the U.S. Federal Governments' AEO 2013 forecast, IHS CERA's 2013 forecast, or the CME Group's Henry Hub Natural Gas Futures prices.

⁶ Energy Northwest. *CGS Long Range Plan*. 16 May 2013.

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Energy Northwest has filed thousands of pages of engineering and environmental studies on the Kalama Energy Center with governmental agencies in Washington state. Many more studies have been filed at FERC to support the pipeline to deliver the natural gas to the plant. The IHS CERA study provided no sources for most of their assumptions.

Not surprisingly, Energy Northwest’s official data describes a combined cycle unit at Kalama that is cheaper, more efficient, and less polluting than the November assumptions:

		Kalama Energy Center	Source	IHS CERA Assumptions	Source
Size	Megawatts	346	Environ P. 3	575	Assumed
Energy	Megawatt-Hours	2,708	Assumed	4,500	Assumed
Capital Cost	\$/kW	\$ 1,156.07	Environ P. 3	1,350	Assumed
Heat Rate	mmbtu/kWh	6,158	Environ P. 18	7,421	Assumed
Fixed O&M	\$/kW/Year	\$ 13.30	Assumed	\$ 13.30	Assumed
Variable O&M	Cents/kWh	\$ 0.37	Environ P. 3	\$ 0.40	Assumed
Emissions	lbs/kWh	795	Environ P. 16	900	Assumed
Emissions Cost	\$/Metric Ton	\$ 1.60	Environ P. 16	\$ 14.00	Assumed

The presentation to the board in 1999 summarized the project:

- Current northwest natural gas prices approximately \$3/MMBtu
- **Current bus bar price \$36 to \$38/MWh with base load operation (at 326MWe and \$3 gas)**
- Potential resource for BPA Tier II resource [Emphasis supplied]⁸

It should be noted that both sets of data were distributed by Energy Northwest. Only the Kalama Project, however, was the subject of numerous board presentations and used in official filings with state and federal agencies. The November study is simply a set of undocumented assumptions.

Natural gas generating stations burn natural gas to produce electricity. The amount of gas used to make electricity is often referred to as the “heat rate.”

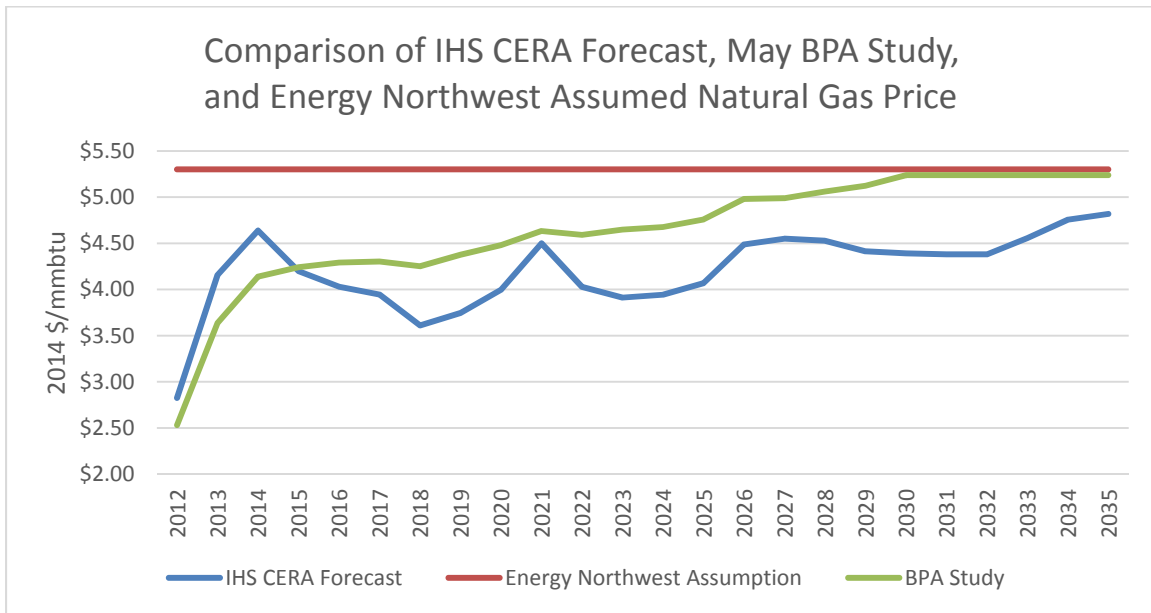
⁷ Environ. *Prevention of Significant Deterioration and Air Discharge Permit Application for a Combined Cycle Combustion Turbine Project Kalama Energy Center Kalama, Washington (Revised)*. Nov. 2011.

⁸ Energy Northwest. *Minutes of Energy Northwest Regular Executive Board Meeting*. 24 Sep. 2009. Page 16.

The heat rate assumed in the IHS CERA report was fully 21% less efficient than Energy Northwest’s official studies.

The natural gas “forecast” assumed in the November study is also pivotal. Natural gas forecasts are part of utility planning and, as such, they are freely available from a number of sources. The U.S. Energy Information Administration’s AEO 2013 forecast is widely used due to its breadth and the availability of regional values. IHS CERA also regularly publishes a detailed forecast.

The published IHS CERA forecast is significantly lower than the \$5.30/mmbtu value assumed in their November study. In fact, the assumed value is higher than the published CERA forecast for its entire duration.⁹



The natural gas forecast used by BPA staff in the earlier Energy Northwest study is also lower than the IHS CERA assumption for the entire period.¹⁰

⁹ Kelly, Ed. *IHS CERA The Future of North American Natural Gas: Issues and Perspectives*. 10 Sept. 2013. Page 37.

¹⁰ Weiss, Steven. *Email entitled FW:CGS Analysis*. 17 June 2013.

Planning Errors

The choice of plant and its location are also incorrect. When McCullough Research conducted a detailed system planning study of the region using the industry standard model, neither this type of plant nor this location were chosen as optimal for new generation over the next forty years.¹¹

The primary problem is that there is a continuing oversupply problem in the Mid-Columbia area – in large part due to renewable resource generation mandated by legislation in California, Oregon and Washington. The availability of intermittent energy has displaced existing CCGTs in the area.

The November study repeats an error from the June study by assuming that the CCGT would be dispatched 90% of the time rather than a more credible 50%. This means that fuel, variable O&M, and emissions costs are roughly twice what comparable units are in the area.

The emissions costs assumed in the study are simply that – assumed. A better choice would be the emission costs set out in WAC 173-407-060(3) -- \$1.60/metric ton. This is the value used in Energy Northwest's own studies submitted to Washington state agencies in support of the Kalama Energy Center.¹²

Correcting Energy Northwest's Assumptions

Computational errors aside, the results are dictated by the assumptions. The assumptions listed in Table 1 of the November report describe a plant significantly less viable than the Kalama Project. A number of the assumptions appear problematic:

1. Natural gas price in 2014 at \$5.30/MMBTU and escalating thereafter at 2.00%. This is a sizable departure from any other forecast and appears to assume that the average over the past twelve years will continue, adjusted for inflation, for

¹¹ The detailed resource planning analysis (including both operating and capital costs) can be found in section 5.6 of our study on page 151. The complete study is available at <http://www.mre-search.com/pdfs/537.pdf>.

¹² Environ. *Prevention of Significant Deterioration and Air Discharge Permit Application for a Combined Cycle Combustion Turbine Project Kalama Energy Center Kalama, Washington (Revised)*. Nov. 2011. Page 16.

the next thirty years. The comparable published forecast from IHS CERA has natural gas prices declining from current levels in real terms. As the IHS CERA web site states:

The North American revolution in unconventional natural gas ranks as the most significant energy innovation so far this century, and because of its scale, requires reassessment of expectations for energy development. It has the potential, at least, of a paradigm shift in the fueling of North America's energy future.¹³

An appropriate natural gas price forecast for the analysis can be taken from any number of sources – in this case, IHS CERA's own published forecast is sufficient.

2. The Kalama Energy Project was to be built for \$1,156/kW as opposed to the assumed \$1,350/kW.
3. Apparently the new combined cycle unit would not be displaced when wind and hydro were available.¹⁴ This is in marked contrast to the operations planned for the Kalama Energy Project and is at odds with other combined cycle units near Hanford. Since 2008, Coyote Springs, for example, has only operated at a little over 50% of capacity. Over the twelve years used to derive the average gas price used in the November analysis, Coyote Springs operated at 63.4% of capacity.
4. The wholesale market purchases are somewhat mysterious. The scenario in the report involves closing CGS midway through a refueling cycle and then purchasing its full output at \$32/MWh until the new power plant is ready, whether or not the energy was needed. Since the short term operating cost of a nuclear unit is very low, the early decommissioning of CGS makes little economic sense – other than to raise costs. After decommissioning, BPA would probably prefer to purchase energy as needed – not the maximum output of CGS.
5. The combination of the wholesale market purchase assumptions and the fuel cost assumption are equally problematic. If the plant's operating cost is based on \$5.40/MMBTU gas and variable O&M of \$4/MWh, the operating cost of

¹³ <http://www.ihc.com/products/cera/multi-client-studies/north-american-energy-future.aspx>

¹⁴ The November report never directly addresses the energy surplus in the area. It does specify generation would be 9,000 MWh per year in its chart on page 10. This value is too high to allow displacement when other, less expensive, energy is available.

the plant is likely to be higher than wholesale market prices for the entire life of the plant – assuming that each is being escalated at 2%.¹⁵ This would make the choice of a combined cycle unit doubtful since a less expensive unit could provide capacity at a much lower price.

6. The CGS assumptions in the November report are equally idiosyncratic. The Capital Expenditures (capex) assumptions assume that CGS will require investments of \$51.7 million per year. CGS's own 10 Year Plan places the value for FY 2014 at \$100.8 million and the ten year annual average at \$93.8 million.
7. The study assumes a \$2/mmbtu fuel cost for nuclear fuel. This would appear to be a typographic error since at 10.464 mmbtu/MWh, this would indicate a CGS fuel cost per MWh of \$20.92/MWh.¹⁶ It appears that the author of this table simply entered the wrong units. The correct fuel cost should be taken from the 2014 10 Year Strategic plan – the average of \$59,579,000 in FY 2014 and \$52,041,000 in FY 2015.
8. The O&M values assumed in the study roughly match the FY 2014 value from the CGS 10 Year Strategic Plan. However, the Strategic Plan forecasts a 5% escalation rate through 2024, not the 2% cited in the study.
9. Finally, although it is unclear how the Paducah transaction affects the study, the description of Energy Northwest's transaction with the U.S. Enrichment Corporation is deeply flawed. For example, the chart on page 10 of the November study indicates that refueling costs are largely eliminated from 2028 through 2040. The footnote explains that “[t]he variation in costs for CGS reflect a combination of changes in O&M every other year for refueling outages and timing of payments that were established in the nuclear fuel purchase contract signed in May 2012 between EN, Tennessee Valley Authority (TVA), the US Enrichment Corporation (USEC), and the Department of Energy (DOE).”¹⁷ The Energy Northwest contract with TVA specifies deliveries through 2022, so the elimination of refueling cycle costs from 2028 through 2040 seems problematic.¹⁸

¹⁵ A heat rate of 7,421 mmbtu/kWh would imply an operating cost for the plant of \$43.33/MWh. The assumed market price of \$32/MWh is significantly lower than the assumed operating cost – so much so that the plant would never run unless market prices surged by 35% at some point.

¹⁶ 2012 EIA Form 923.

¹⁷ CERA. *Columbia Generating Station: Economic assessment*. 6 Nov. 2013. Page 10.

¹⁸ TVA/EN. *Enriched Product and Uf6 Supply Agreement Between Tennessee Valley Authority and Energy Northwest*. 15 May 2012. Page 8.

10. Energy Northwest has purchased fuel from one of the dirtiest nuclear industrial facilities in the United States for the past eight years. Its 2014 fuel plan uses fuel from Paducah for some years to come.¹⁹ The nuclear fuel cycle will become more environmentally friendly as the older gaseous diffusion enrichment plants are closed.²⁰ Forecasting the pace of closure for the older facilities is difficult and estimating the share of CGS' future fuel from such facilities is impossible. The greenhouse gas emissions from older facilities like Paducah is quite high, but Paducah itself has been closed, partially destroyed by a tornado, and its owner has declared its intention to enter bankruptcy. Using the standard CO₂ calculator and the estimated energy intensity of the new enrichment facility at Eunice, New Mexico would estimate a CO₂ output of 63,201 metric tons per year.^{21,22}

The following table shows the results when assumptions in the study that are at odds with Energy Northwest source materials and the IHS CERA natural gas forecast are corrected:

	November Report CGS	CGS	November Report CCGT	CCGT
1 Capital costs	0.68	1.15	0.94	0.69
2 Fixed O&M	3.11	3.00	0.15	0.13
3 Variable O&M	0.62	0.79	0.31	0.18
4 Fuel costs	0.72	0.69	3.10	1.22
5 Insurance	0.05	0.04	0.03	0.03
6 Taxes	0.08	0.09	0.08	0.05
7 wholesale market purchases			1.89	0.55
8 CO ₂ emissions	0.00		0.38	0.05
Total	5.26	5.76	6.88	2.90

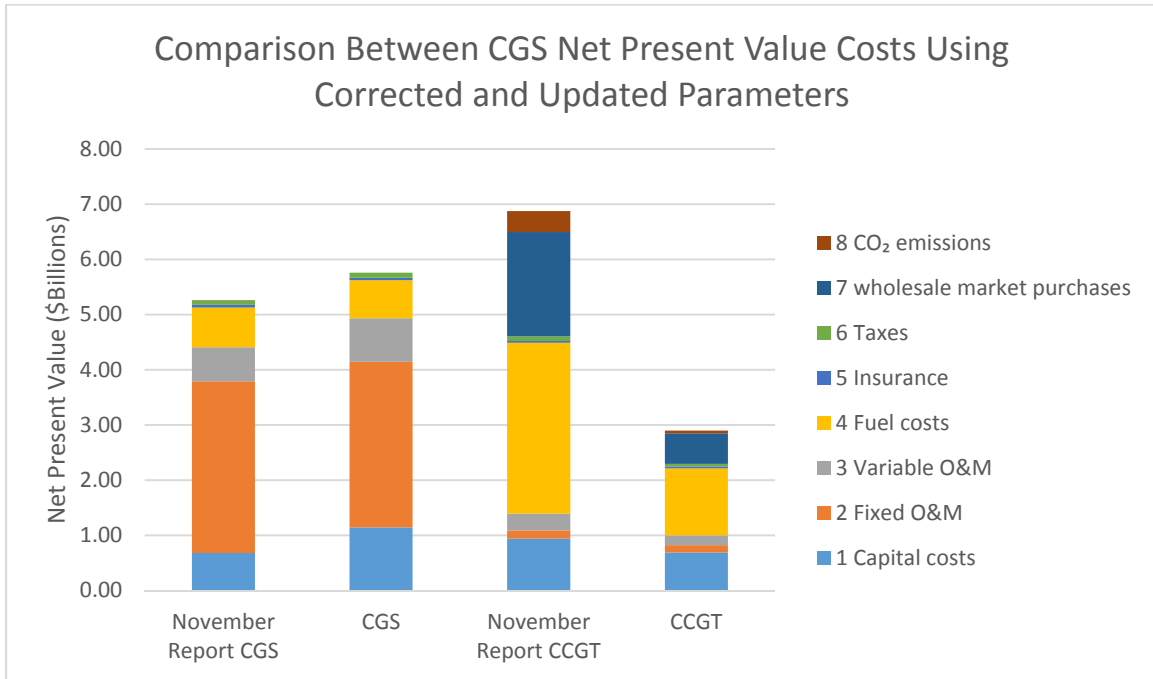
¹⁹ Praetorius, S.M. *Draft FY 2014 Fuel Management Plan*. Energy Northwest. Mar. 2013.

²⁰ Ibid. Page. 6.

²¹ <http://www.wise-uranium.org/nfce.html>

²² Nuclear Regulatory Commission. *Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico*. June 2005. Page 2-14.

The result shows a differential between a Kalama Energy Center based project and CGS in favor of the Kalama Energy Center by \$2.86 billion dollars. Not surprisingly, the major difference is using IHS CERA’s own published natural gas forecast and the parameters for the Kalama Energy Center for capital and operating costs.



As our report made very clear, these are interesting calculations, but only that. The right approach to valuation is to issue an RFP and see how real prices compare with the cost of CGS.